

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

AP
JFW

Applicant: Alan R. Reinberg

Title: METHOD FOR REDUCING SINGLE BIT DATA LOSS IN A MEMORY CIRCUIT

Docket No.: 303.522US1

Filed: August 25, 1999

Examiner: Richard Booth

Serial No.: 09/382,442

Due Date: July 13, 2004

Group Art Unit: 2812



MS Appeal Brief--Patents

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

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☒ A return postcard.

☒ A Reply Brief (in triplicate) (4 Pages).

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SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.

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SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.

(GENERAL)

S/N 09/382,442

PATENT

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REPLY BRIEF UNDER 37 CFR 1.193(b)

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Alexandria, VA 22313-1450

This Reply Brief is filed in triplicate and presented in response to the Examiner's Answer (the "Answer") dated May 13, 2004. The Appellants respectfully request acknowledgment of receipt, and entry of this Reply Brief in the above-identified Application for review by the United States Patent and Trademark Office Board of Patent Appeals and Interferences (the "Board").

REPLY

In the Examiner's answer mailed 5/13/2004, the Examiner acknowledged that the Nakanishi patent, 5,145,797, does not "disclose heating the layer in an atmosphere comprising a hydrogen isotope wherein the hydrogen isotope is incorporated into the layer; and heating the gate region and the thin layer in an atmosphere comprising a hydrogen isotope" as is claimed in the present application. The Examiner states that Nakanishi describes "providing a semiconductor layer 1 having a surface; heating the layer in an atmosphere during thermal oxidation wherein hydrogen is inherently incorporated into the layer." The Examiner goes on to argue that because "admitted prior art discloses performing a post-metal passivation process using hydrogen",...it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Nakanishi so as to perform a post-metal passivation process so as to heat the gate region and thin layer using hydrogen as suggested by the admitted prior art because such a process is commonly used and suitable for reducing defects in completed devices."

The Applicant responded that the Nakanishi patent described treating the sidewall of the floating gate electrode by thermal oxidation in a dry oxygen atmosphere at 900 degrees C. (See col. 2, lines 49-60.) The Examiner cites Lisenker et al. at page 3, lines 8-24, as supporting the assertion that a dry oxygen atmosphere "unintentionally" introduces hydrogen into the process.

The Applicant asserts that the Lisenker reference is a lot more equivocal in stating that some "contaminating" water is "usually" present, and cites a specific treatment using trichloroethane as producing some water. (See page 3, lines 10-25.) Lisenker makes no statement concerning the activity of the water in a dry oxygen atmosphere or any subsequent breakdown of the water to hydrogen under conditions of dry oxygen thermal oxidation or any capacity for any hydrogen to be incorporated into a silicon oxide layer.

In the Answer, the Examiner stated that the applicant "has not pointed out which statements make" the assertion that deuterium treatment would not be effective in an erase operation. In responses filed September 20, 2001, and December 10, 2001, Applicant addressed the Examiner's assertion in the following statements:

The Examiner's assertion that it is obvious that a FLASH memory cell would benefit in the same way as other types of memory cells from deuterium fabrication does not account for differences in operation of a FLASH memory cell, as opposed to a MOSFET.

In a FLASH memory cell, programming operation is performed by channel hot electron injection. However, an erase operation is carried out by extracting the stored electron from the floating gate to erase gate, for all the bits, at the same time. For a FLASH memory to operate successfully, both the programming operation and the erase operation must operate in a satisfactory manner. There is no precedent in the references cited by the Examiner, to suggest that deuterium treatment will improve both programming and erasing in order to reduce random bit data loss.

The Applicant asserts that it is not obvious that the degree of electron trapping required during write/erase operation is met by deuterium doping, based upon the references cited.

The references do not have the same operation sequence. FLASH memory requires multiple sets of voltages for programming, erase, and read operations. FLASH memory characteristics are degrading because of stress by both programming and erasing and not just by programming. FLASH memory employs digital and analog design concepts. The effect that deuterium has on these features is not addressed by the art cited by the Examiner and cannot be presumed based upon what has been claimed and described in the present invention. (Response of September 20, 2001)

The Examiner is maintaining rejection by focusing on the Clark reference which mentions that deuterium provides greater resistance to hot electron stresses than hydrogen. The hot electron stresses referred to are those in MOSFET devices, TFT's, polyresistors and polyemitter bipolars. As has been discussed, none of these references describes a use of deuterium for reducing random single bit data loss in a FLASH memory cell. The significance of this difference is that FLASH memory includes a programming operation and an erase operation. Both the programming operation and the erase operation must operate in a satisfactory manner for the FLASH memory to perform acceptably. None of the MOSFET devices, TFT's, polyresistors or polyemitter bipolars operate with this two step operation. Thus, there is no precedent in the references cited by the Examiner for concluding that deuterium substitution would work at all to reduce random single bit data loss in a memory cell. The observations described in Lisenker et al. patent suggest that deuterium treatment would not be effective in an erase operation because deuterium does not have the same removal properties as hydrogen. Thus, there is no suggestion that single bit data loss is reduced by deuterium because the references cited provide no description of how deuterium affects erasing operations. (Response of December 10, 2001)

The combination of Lisenker and Nakanishi do not render the claimed invention obvious because the Nakanishi patent does not describe a method that uses deuterium at all. The citation of the Nakanishi patent supports the Applicant's argument that the invention claimed is not obvious because Nakanishi does not overcome the Applicant's assertion that the prospect of using of deuterium in a FLASH memory was not considered, prior to the Applicant's invention. Applicant asserts that it is hindsight alone that is the glue holding the Lisenker reference and the Nakanishi reference together.

The Examiner's combination of Nakanishi, Nakajima, and Sheu references with Linsenker fails to address the applicant's assertion that it is not obvious to employ a deuterium treatment in a process that employs a programming operation and an erase operation because deuterium does not have the same removal properties as hydrogen and the effect of deuterium on an erase operation is not obvious. Lisenker describes deuterium containing bonds as "less likely to break on exposure to electrical stresses." (page 6, lines 4-5). This observation of the Lisenker reference teaches away from using deuterium in a process that employs an erase operation because of the uncertainty of the removal of deuterium, as acknowledged in the Lisenker

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reference. The Nakanishi, Nakajima, and Sheu references do not describe a use of deuterium or any other hydrogen isotope so they do not provide support for the suitability of using deuterium in an erase operation.

Because the references do not render the invention claimed obvious, the Applicant respectfully requests the Board to reconsider the rejection and allow the claims.

CONCLUSION

The Examiner is invited to telephone the undersigned to facilitate prosecution of this Application. Should the Board be of the opinion that any rejected claim is allowable in amended form, an explicit statement to that effect is also respectfully requested. If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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By his Representatives,

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Signature

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